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Original Research

Evaluation of outpatient COVID-19 patients' readmissions to the emergency department

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Abstract

Aim: In this study, we aimed to analyze variables regarding emergency department (ED) readmissions of COVID-19 patients who were treated as outpatients.
Material and Methods: This is a retrospective observational study. COVID-19 PCR- positive patients treated on an outpatient basis who were admitted to the ED during the treatment period or in the first week of the post-treatment period were analyzed. Demographic findings, complaints, comorbidities, vital parameters, laboratory, radiologic findings, and outcomes were analyzed by using the data registration system of the hospital.
Results: A total of 505 patients were evaluated, with the median age of 57 and 45% were female. Fever (%73), cough and dyspnea (%56 each) were the most common complaints. Two-thirds of the patients had two or more comorbidities. There was significant progress in radiologic and laboratory findings. Forty-one percent were hospitalized in inpatient clinics, and 15% in intensive care units on readmission to the ED. Fifty-one patients died.
Discussion: In COVID-19 patients with mild symptoms and favorable laboratory and radiological findings on index admission, followed up as outpatients, the disease might progress rapidly and readmission to ED, need for hospitalization and even death may occur. Thus, close follow-up of patients and being alert to new symptoms and signs that may develop is necessary.

Keywords
COVID-19, Emergency Department, Readmission

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Introduction

The COVID-19 pandemic has placed a severe burden on health care systems over the past two years, especially the emergency departments (ED) of countries. Emergency admissions of outpatients with COVID constitute a significant part of this burden. The reason for the clinical deterioration of those patients might vary. The development or progression of ongoing pneumonia, cytokine storm, and systemic inflammatory response and complications are common reasons for hospital readmissions [1-3].

To reduce the number of readmissions, which significantly increase the burden on healthcare providers, the determination of risk factors is very important [4]. Therefore, in this study, we aimed to analyze variables regarding readmissions of COVID-19 patients who were treated as outpatients to the emergency department.

Material and Methods

This is a retrospective observational study conducted in a training and research hospital after approval of the local ethics committee of Keçiören Training and Research Hospital (Date: 2021-04-13, No: 2012-KAEK-15/2279). Patients, who already tested positive for COVID-19 by PCR and were treated on an outpatient basis and admitted to the ED during treatment period or in the first week of the post-treatment period were analyzed.

Demographic findings, complaints at admission, comorbidities, vital parameters, laboratory findings, complications if present, ventilatory support at ED, and outcomes were analyzed by using the data registration system of the hospital and recorded on study forms. Patients with missing data and patients younger than 18 years of age were excluded.

The first admission of patients to the hospital at which the COVID-19 was diagnosed was defined as an index admission. ED admission of the patients during ongoing treatment or post-treatment period, which is defined above, was the second admission. Radiological findings of the patients were evaluated according to local guidelines (available at: https://covid19.saglik.gov.tr/TR-66301/covid-19-rehberi.html). According to the distribution of lesions, radiographic findings were scored as 0: normal, 1:mild, 2:moderate, and 3: severe.

Statistical analyses were performed by SPSS22.0 (Chicago, IL, USA). After analyzing the distribution of normality, data were presented as mean±SD or median and interquartile range (IQR)25-75. Categorical variables were presented as percentages. The Wilcoxon test was used for analyzes. A p-value <0.05 was considered statistically significant.

Ethical Approval

Ethics Committee approval for the study was obtained.

Results

The number of patients admitted to the ED during their outpatient COVID treatment period or in the first week of the post-treatment period was 505. Forty-five percent of them were female, and the median age was 57 years. Only 25 of those patients were hospitalized during their index visit (hospital visit when the diagnosis was made). The time period between PCR positivity and readmission to ED was 7 (IQR 5-10) days. The most common symptoms during readmission were fever, cough, and dyspnea. One-third of the patients had two or more comorbid conditions. Nearly all patients were taking favipiravir, and one-fourth were using enoxaparin sodium. The general characteristics of patients are summarized in Table 1.

Laboratory parameters of the patients showed that lactate dehydrogenase, ferritin, D-dimer, troponin, fibrinogen, C reactive protein and lactate levels were significantly higher at the second admission of the patients compared to their index admission. There was also a significant decrease in their lymphocyte counts (Table 2).

Radiological findings of the patients were analyzed. At the index admission, the number of radiologic imaging was less, and most of the images were regarded as normal or mild pneumonia. At the second admission, most of the patients were evaluated with thorax tomography (CT), and lesions showed progression with a quarter of thorax CT's having severe lesions (Table 2).

All values were given as median (Interquartile range 25 – 75). Wilcoxon test was used, p-value <0,05 was considered statistically significant.

Nearly all patients needed oxygen support during their second visit. Seven percent of the patient were intubated. Forty-three percent of the patients were discharged at their ED admission; 41% admitted to inpatient clinics and 15% admitted to the

Table 1. General characteristics of patients admitted to ED during ongoing outpatient COVID-19 treatment.

N= 505	
Gender	
Male	278 (%55)
Female	227 (%45)
Age	57 (IQR 45 – 70)
Hospitalization at first admission (Admission at which COVID-19 diagnosed)	
Yes	25 (%5)
No	480 (%95)
Time period between PCR test positivity and re-admission to ED	7 (IQR 5 – 10) days
Complaints at ED admission	
Dyspnea	56,60%
Cough	56,50%
Fever	73,40%
Enteritis	25,30%
Headache / throat ache	27,40%
Arthralgia	57,80%
Other	53,10%
Comorbid conditions	
Hypertension	36,60%
Diabetes mellitus	17,50%
Coronary artery disease	19,80%
Congestive heart failure	4,40%
Chronic obstructive pulmonary disease	9,10%
Chronic kidney disease/failure	5,20%
Others	17,40%
Patients with two or more comorbid conditions	36%
Patients with three or more comorbid conditions	17,40%
Current treatments of patients at the time of emergency admission	
Favipiravir	97,40%
Enoxaparin sodium	25,20%

Abbreviations: ED; emergency department

Table 2. CComparison of laboratory results and radiological findings of patients at the first admission at which COVID-19 diagnosed and at the second admission during ongoing treatment.

Laboratory parameters	Results at the first admission at which COVID-19 diagnosed	Results at the 2nd admission (during ongoing treatment)	P value
Urea (mg/dL)	30 (IQR 23 – 38)	32 (IQR 23,5 – 45)	0,001
Creatinine (mg/dL)	1 (IQR 0,84 – 1,16)	0,98 (IQR 0,81 – 1,15)	0,07
Albumin (g/dL)	4,1 (IQR 3,8 – 4,4)	3,6 (IQR 3,3 – 4,1)	<0,001
LDH (U/L)	225 (IQR 193 – 283)	285 (IQR 217 – 377)	<0,001
Sodium (mmol/L)	138 (IQR 136 – 140)	138 (IQR 134 – 140)	0,18
CRP (mg/L)	13 (IQR 4,15 – 34)	54,5 (IQR 10 – 126)	<0,001
WBC (103/UL)	6,1 (IQR 5 – 7,8)	7 (IQR 5,4 – 9,1)	<0,001
Lymphocyte (103/µL)	1,39 (IQR 1 – 1,97)	1,23 (IQR 0,82 – 1,84)	0,003
Platelets (103/UL)	202,5 (IQR 164 – 249)	222 (IQR 175 – 280)	<0,001
MPV (fl)	9,7 (IQR 9,1 – 10,3)	9,7 (IQR 9,1 – 10,5)	0,57
Ferritin (ng/mL)	119 (IQR 40,5 – 242,2)	256 (IQR 101,5 – 542,5)	<0,001
Troponin (ng/mL)	3 (IQR 1 – 7,21)	4,73 (IQR 1 – 13,04)	0,002
D Dimer (ng/mL)	390 (IQR 260 -770)	675 (IQR 370 – 1360)	<0,001
Fibrinogen (mg/dL)	370,5 (IQR 290,5 – 448,25)	475 (IQR 336 – 687)	0,006
pH	7,40 (IQR 7,35 – 7,45)	7,41 (IQR 7,38 – 7,46)	0,79
Lactate (mmol/L)	1,5 (IQR 1 – 2)	1,9 (IQR 1,37 – 3)	0,001
Imaging method			
Direct lung graphs	n=122	n=91	
0: Normal/ suspicious lesion	87	43	
1: Mild	30	31	
2: Moderate	5	11	0,008
3: Severe	-	6	
Median (IQR 25 -75)	0 (IQR 0 – 1)	1 (IQR 1 – 1)	
Computed tomography of the thorax	n=134	n=365	
0: Normal/ suspicious lesion	60	66	
1: Mild	44	93	
2: Moderate	28	119	<0,001
3: Severe	2	87	
Median (IQR 25 -75)	0 (IQR 1 – 1)	2 (IQR 1 – 2)	

Abbreviations: LDH; lactate dehydrogenase, CRP; C reactive protein, WBC; white blood cell, MPV; mean platelet volume, IQR; interquartile range

Table 3. Vital signs, oxygen treatment management and outcomes of patients admitted to the ED during ongoing outpatient COVID-19 treatment.

	N=505
Vital sings	
Glasgow coma score	15 (IQR 15 – 15)
Systolic blood pressure (mmHg)	139 (IQR 120 – 140)
Diastolic blood pressure (mmHg)	76 (IQR 65 – 89)
Heart rate/minute	67 (IQR 56 – 79)
Respiration rate/minute	14 (IQR 12 – 18)
Fever (C°)	37 (IQR 36 – 38)
Oxygen saturation (%)	92 (IQR 88 – 96)
Oxygen treatment management	
Nasal oxygen treatment	53,80%
Oxygen treatment with mask	53,20%
High flow nasal cannula	15,90%
Intubation	7,10%
Emergency department outcomes at 2nd admission	
Discharge	43,20%
Admitted to the inpatient clinic	41,30%
Admitted to the intensive care unit	15,50%
Transferred to another hospital in total	5%
Dead in total	10,50%

intensive care unit. In total 51 patients died (Table 3).

Discussion

This study demonstrated that COVID-19 patients who had mild symptoms at index admission with favorable laboratory and radiologic findings, might progress during their outpatient follow-up, and readmissions to ED occur mostly between the 5th-10th days of PCR positivity.

In the past two years, the COVID-19 pandemic has taken up much of the academic agenda. With the rapidly increasing number of cases that exceed the health care capacity, outpatient follow-up of mild cases and discharge of inpatients as soon as possible were planned. Thus, since readmission of these patients would cause a severe health burden, many studies have been conducted to examine the rates and risk factors of readmission [5, 6].

Studies demonstrated that among discharged patients, the rate of re-hospitalization was 5-15% [7]. It is shown that the male gender is a risk factor for the readmission, similar to our results [7]. Cough and dyspnea were found to be the most frequent reasons for return visits [8]. Another important risk factor for readmissions is comorbid conditions. Nematshahi et

al. demonstrated that diabetes and high creatine levels were the most important predictors of readmissions [9]. On the other hand, there were also studies showing especially cardiac and pulmonary conditions as important risk factors for revisits [10, 11]. In our study group, comorbid conditions were present, but creatine levels were normal. Also, those studies included patients who were hospitalized at their index visits. There are limited studies about the readmission characteristics of mild/outpatient COVID-19 patients.

Among return visits, when the ED representations are evaluated, it was found that, revisit rates might be as high as 20% or more [12]. Haag et al. showed in their study which was conducted with outpatient COVID-19 patients, similar to ours, the median ED readmission occurred on day 9, and nearly 45% of them need hospitalization on their second visit [13]. According to a study from Argentine, previous smoking, fever, and oxygen saturation were determined as risk factors for ED readmission of mild COVID patients who were discharged at index hospital visits and followed at home [14]. Supporting this study, our study showed that the most common reasons for ED readmissions were fever, cough, and dyspnea.

Our study showed that laboratory parameters such as CRP, WBC, ferritin, troponin, D dimer, lactate, fibrinogen were significantly higher at second admission. Those markers were evaluated at COVID-19, those changes were predictable and were similar to the literature [8]. In another study Somani et al. claimed that lower in-hospital anticoagulation rates were associated with ED readmissions [15]. In our study, only one-fourth of the patients were treated with anticoagulants but our data are not appropriate for detecting an association between anticoagulation and readmissions.

Limitations

Our study has some important limitations. First, this was a single-centered study, and we could not evaluate patients who might revisit different health centers. Since we did not have a control group, we could not analyze the difference between readmitted and not-readmitted patients. Due to the retrospective nature of the study and the use of only the data registration system, we could not reach information such as smoking habits, which might be a risk factor for readmission.

Conclusion

In COVID19 patients with mild symptoms and favorable laboratory and radiological findings during index hospital admission, followed up as outpatients, the disease may progress rapidly and readmission to the ED, the need for hospitalization and even death may occur. Thus, close follow-up of patients and being alert to new symptoms and signs that may develop, is necessary.

Scientific Responsibility Statement

The authors declare that they are responsible for the article's scientific content including study design, data collection, analysis and interpretation, writing, some of the main line, or all of the preparation and scientific review of the contents and approval of the final version of the article.

Animal and human rights statement

All procedures performed in this study were in accordance with the ethical standards of the institutional and/or national research committee and with the 1964 Helsinki Declaration and its later amendments or comparable ethical standards.

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Conflict of interest

None of the authors received any type of financial support that could be considered potential conflict of interest regarding the manuscript or its submission.

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